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| **Dataset Expocode** | **33HH20161101** |
| **Primary Contact** | **Name:** Sullivan, Kevin<br>**Organization:** NOAA/Atlantic Oceanographic & Meteorological Laboratory<br>**Address:** 4301 Rickenbacker Causeway<br>**Phone:** 305-361-4382<br>**Email:** Kevin.Sullivan@noaa.gov |
| **Investigator** | **Name:** Wanninkhof, Rik<br>**Organization:** NOAA/Atlantic Oceanographic & Meteorological Laboratory<br>**Address:** 4301 Rickenbacker Causeway, Miami Fl, 33149<br>**Phone:** 305-361-4379<br>**Email:** Rik.Wanninkhof@noaa.gov |
| **Dataset** | **Funding Info:** NOAA Climate Program Office; NOAA Ocean Acidification Program<br>**Initial Submission (yyyymmdd):** 20161117<br>**Revised Submission (yyyymmdd):** 20161117 |
| **Campaign/Cruise** | **Expocode:** 33HH20161101<br>**Campaign/Cruise Name:** HB1604-Leg4<br>**Campaign/Cruise Info:** AOML_SOOP_CO2, Autumn Bottom Trawl Survey<br>**Platform Type:**<br>**CO2 Instrument Type:** Equilibrator-IR or CRDS or GC<br>**Survey Type:** Research Cruise<br>**Vessel Name:** R/V Henry B. Bigelow<br>**Vessel Owner:** NOAA<br>**Vessel Code:** 33HH |
| **Coverage** | **Start Date (yyyymmdd):** 20161101<br>**End Date (yyyymmdd):** 20161110<br>**Westernmost Longitude:** 71.4 W<br>**Easternmost Longitude:** 66.5 W<br>**Northernmost Latitude:** 44.5 N<br>**Southernmost Latitude:** 41.1 N<br>**Port of Call:** Newport, RI |
| **Variable** | **Name:** xCO2_EQU_ppm<br>**Unit:** ppm<br>**Description:** Mole fraction of CO2 in the equilibrator headspace (dry) at equilibrator temperature (ppm) |
| **Variable** | **Name:** xCO2_ATM_ppm<br>**Unit:** ppm<br>**Description:** Mole fraction of CO2 measured in dry outside air (ppm) |
| **Variable** | **Name:** xCO2_ATM_interpolated_ppm<br>**Unit:** ppm<br>**Description:** Mole fraction of CO2 in outside air associated with each water analysis. These values are interpolated between the bracketing averaged good xCO2_ATM analyses (ppm) |
| **Variable** | **Name:** PRES_EQU_hPa<br>**Unit:** hPa<br>**Description:** Barometric pressure in the equilibrator headspace (hPa) |
| **Variable** | **Name:** PRES_ATM@SSP_hPa<br>**Unit:** hPa |

**Description:** Barometric pressure measured outside, corrected to sea level (hPa)

| **Variable** | **Name:** TEMP_EQU_C |
| | **Unit:** Degree C |
| | **Description:** Water temperature in equilibrator (°C) |

| **Variable** | **Name:** SST_C |
| | **Unit:** Degree C |
| | **Description:** Sea surface temperature (°C) |

| **Variable** | **Name:** SAL_permil |
| | **Unit:** ppt |
| | **Description:** Sea surface salinity on Practical Salinity Scale (o/oo) |

| **Variable** | **Name:** fCO2_SW@SST_uatm |
| | **Unit:** µatm |
| | **Description:** Fugacity of $CO_2$ in sea water at SST and 100% humidity (µatm) |

| **Variable** | **Name:** fCO2_ATM_interpolated_uatm |
| | **Unit:** µatm |
| | **Description:** Fugacity of $CO_2$ in air corresponding to the interpolated $xCO_2$ at SST and 100% humidity (µatm) |

| **Variable** | **Name:** dfCO2_uatm |
| | **Unit:** µatm |
| | **Description:** Sea water $fCO_2$ minus interpolated air $fCO_2$ (µatm) |

| **Variable** | **Name:** WOCE_QC_FLAG |
| | **Unit:** None |
| | **Description:** Quality control flag for $fCO_2$ values (2=good, 3=questionable) |

| **Variable** | **Name:** QC_SUBFLAG |
| | **Unit:** None |
| | **Description:** Quality control subflag for $fCO_2$ values, provides explanation when QC flag=3 |

| **Sea Surface Temperature** | **Location:** After sea water pump, ~3 m below sea surface |
| | **Manufacturer:** Seabird, Inc. |
| | **Model:** SBE 38 |
| | **Accuracy:** 0.001 (°C if units not given) |
| | **Precision:** 0.0003 (°C if units not given) |
| | **Calibration:** Factory calibration |
| | **Comments:** Manufacturer's Resolution is taken as Precision; Maintained by ship. |

| **Sea Surface Salinity** | **Location:** In dry lab after a debubbler, next to $CO_2$ system |
| | **Manufacturer:** Seabird |
| | **Model:** SBE 45 |
| | **Accuracy:** ± 0.005 o/oo |
| | **Precision:** 0.0002 o/oo |
| | **Calibration:** Factory calibration |
| | **Comments:** Manufacturer's Resolution is taken as Precision; Maintained by ship. |

| **Atmospheric Pressure** | **Location:** On mast above the bridge at ~18 m above sea surface water |
| | **Normalized to Sea Level:** yes |
| | **Manufacturer:** Vaisala |
| | **Model:** PTB220 |
| | **Accuracy:** ± 0.15 hPa (hPa if units not given) |
| | **Precision:** 0.01 hPa (hPa if units not given) |

**Calibration:** Factory calibration
**Comments:** Manufacturer's Resolution is taken as Precision; Maintained by ship.

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| **Atmospheric CO2** | **Measured/Frequency:** Yes, 5 readings in a group every 3.5 hours<br>**Intake Location:** Mast above the bridge, ~18 meters above sea surface<br>**Drying Method:** Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).<br>**Atmospheric CO2 Accuracy:** ± 0.5 µatm in fCO2_ATM<br>**Atmospheric CO2 Precision:** ± 0.01 µatm in fCO2_ATM |
| **Aqueous CO2 Equilibrator Design** | **System Manufacturer:**<br>**Intake Depth:** 3 meters<br>**Intake Location:** Bow<br>**Equilibration Type:** Spray head above dynamic pool with thermal jacket<br>**Equilibrator Volume (L):** 0.95 L (0.4 L water, 0.55 L headspace)<br>**Headspace Gas Flow Rate (ml/min):** 70 - 150 ml/min<br>**Equilibrator Water Flow Rate (L/min):** 1.5 - 2.0 L/min<br>**Equilibrator Vented:** Yes<br>**Equilibration Comments:** Primary equilibrator is vented through a secondary equilibrator.<br>**Drying Method:** Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry). |
| **Aqueous CO2 Sensor Details** | **Measurement Method:** IR<br>**Method details:** details of CO2 sensing (not required)<br>**Manufacturer:** LI-COR<br>**Model:** 6262<br>**Measured CO2 Values:** xco2(dry)<br>**Measurement Frequency:** Every 140 seconds, except during calibration<br>**Aqueous CO2 Accuracy:** ± 2 µatm in fCO2_SW<br>**Aqueous CO2 Precision:** ± 0.01 µatm in fCO2_SW<br>**Sensor Calibrations:**<br>**Calibration of Calibration Gases:** The analyzer is calibrated every 3.5 hours with field standards that in turn were calibrated with primary standards that are directly traceable to the WMO scale. The zero gas is ultra-high purity air.<br>**Number Non-Zero Gas Standards:** 4<br>**Calibration Gases:**<br><br>Std 1: JA02166, 232.80 ppm, owned by AOML, used every ~3.5 hours.<br>Std 2: JB03651, 306.46 ppm, owned by AOML, used every ~3.5 hours.<br>Std 3: JB03591, 409.69 ppm, owned by AOML, used every ~3.5 hours.<br>Std 4: JB03285, 565.58 ppm, owned by AOML, used every ~3.5 hours.<br>Std 5: 0.00 ppm, owned by AOML, used every ~17.0 hours.<br>**Comparison to Other CO2 Analyses:**<br>**Comments:**<br>**Method Reference:**<br>Pierrot, D., C. Neil, K. Sullivan, R. Castle, R. Wanninkhof, H. Lueger, T. Johannessen, A. Olsen, R. A. Feely, and C. E. Cosca (2009), Recommendations for autonomous underway pCO2 measuring systems and data reduction routines, Deep-Sea Res II, 56, 512-522. |

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| **Equilibrator Temperature Sensor** | **Location:** Inserted into equilibrator ~5 cm below water level<br>**Manufacturer:** Hart<br>**Model:** 1523<br>**Accuracy:** 0.015 (°C if units not given)<br>**Precision:** 0.0003 (°C if units not given)<br>**Calibration:** Factory calibration<br>**Comments:** Resolution is taken as Precision. |
| **Equilibrator Pressure Sensor** | **Location:** Attached to equilibrator headspace. Differential pressure reading from Setra 239 attached to the equilibrator headspace is added to the pressure reading from the LICOR, which is measured by an external Setra 270 connected to the exit of the analyzer.<br>**Manufacturer:** Setra<br>**Model:** 270<br>**Accuracy:** 0.15 (hPa if units not given)<br>**Precision:** 0.015 (hPa if units not given)<br>**Calibration:** Factory calibration<br>**Comments:** Manufacturer's Resolution is taken as Precision. |
| **Additional Information** | **Suggested QC flag from Data Provider:** NA<br>**Additional Comments:** The analytical system behaved fine throughout the cruise. During the intervals of YearDay 306.86 - 308.67 and 312.98 - 314.30, the water flow sensor was very variable and read zero often. Data from the various temperature sensors and from the CO2 analyzer do not confirm low/no water flow. The flow sensor was probably not operating reliably, even though seawater was flowing. There were reports of jelly fish in the pumping system, so it is possible that the water flow sensor was fouled. There were multiple small gaps in the ship's sensors. The barometric pressures were estimated by subtracting 1.4 mbar from the Licor Pressure; [the difference between the LICOR and barometric pressures was 1.45 (+/-0.26) mbar, n=11827, for legs 3-4]. The SSTemperatures were estimated by subtracting 0.41 deg C from the Equilibrator temperature; [the difference between the Equilibrator and SSTemperatures was 0.41 (+/-0.06) deg C, n=12291, for legs 3-4]. The salinity values were interpolated from surrounding good data. Original Data Location: http://www.aoml.noaa.gov/ocd/ocdweb/bigelow/bigelow_introduction.html<br>**Citation for this Dataset:**<br>**Other References for this Dataset:** |